

# Cognitive Music Modelling: An Information Dynamics Approach

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**Abstract**—People take in information when perceiving music. With it they continually build predictive models of what is going to happen. There is a relationship between information measures and how we perceive music. An information theoretic approach to music cognition is thus a fruitful avenue of research.

## I. INTRO

### A. Information Theory and Prediction

Bayesian probability and modelling the building of predictions

### B. Link to music

Music as a temporal pattern. Meyer, Narmour. Music unfolding in time. How listeners see different kinds of predictability in musical patterns..

## II. INFORMATION DYNAMICS APPROACH

### A. Re-iterate core hypothesis

### B. models/parameters/observations

The grouping of elements into past, present and future..s

### C. Information measures

Predictive information rate as a measure of structure Crutchfield papers, anatomy of abit

### D. Case of this approach being good at modelling music cognition

Inverted U

## III. APPLICATIONS

### A. In Analysis

refer to the work with the analysis of minimalist pieces

Content analysis - Sound Categorisation. Using Information Dynamics it is possible to segment music. From there we can then use this to search large data sets. Determine musical structure for the purpose of playlist navigation and search. (Peter)

### B. Beat Tracking

Bayesian belief can be used to predict when things happen (as oppose to just what happens). Information Dynamics of?

### C. Information Dynamics as Design Tool

In addition to using Information Dynamics in the analysis of music, it is also possible to apply this approach in the composition of musical materials. By providing a framework for linking information theoretic measures to the control of generative processes, it becomes possible to steer

1) *The Melody Triangle: What the Melody Triangle is...*

*The Melody Triangle as Composition Assistant...*

*comparable tools* The use of stochastic processes for the generation of musical material has been widespread for decades. Just as Information Theory was coming of age Iannis Xenakis applied probabilistic mathematical models to the creation of musical materials. This included the formulation of a theory of Markovian Stochastic Music. With the Melody Triangle similar processes generate the content, however we are able to explore and interface with these processes at the high and abstract level of expectation, randomness and predictability.

*Using the Melody Triangle for the generation of non-sonic content (maybe)*

### D. Information Dynamics as Evaluative Feedback Mechanism

*comparable system* Gordon Pask's Musicolor (1953) applied a similar notion of boredom in its design. The Musicolor would react to audio input through a microphone by flashing coloured lights. Rather than a direct mapping of sound to light, Pask designed the device to be a partner to a performing musician. It would adapt its lighting pattern based on the rhythms and frequencies it would hear, quickly 'learning' to flash in time with the music. However Pask endowed the device with the ability to 'be bored'; if the rhythmic and frequency content of the input remained the same for too long it would listen for other rhythms and frequencies, only lighting when it heard these. As the Musicolor would 'get bored', the musician would have to change and vary their playing, eliciting new and unexpected outputs in trying to keep the Musicolor interested.

In a similar vain, our *Information Dynamics Critic*(name?) allows for an evaluative measure of an input stream, however containing a more sophisticated notion of boredom that ...

### E. Musical Preference and Information Dynamics

Any results from this study

#### IV. CONCLUSION